

#### **IV. SUMMARY AND CONCLUSIONS**

This study is a comprehensive analysis of the nutrient adequacy of subgroups at risk of inadequate nutrient intake, excessive intake, or dietary imbalances. It adds to a growing literature that uses improved knowledge of nutrient requirements (DRIs) and recommended nutrient assessment methods to assess nutrient intakes. The study indicates inadequate intakes of key micronutrients, especially magnesium, calcium, folate, and vitamin E; reported energy intakes less than estimated energy requirements for adults; too much food energy from fat and not enough from carbohydrate; and inadequate intakes of fiber. In addition, the adequacy of diets deteriorates as individuals get older. Children—especially infants and young children—have diets that are more nutritionally adequate than adolescents and adults.

In interpreting these results, several limitations of the data must be noted. First, the CSFII data are nearly 10 years old now, and there have been substantial changes in food fortification, program regulations, and food consumption patterns since the CSFII data collection. For example, although the study results indicate a high prevalence of inadequacy for folate, current estimates of inadequacy based on Dietary Folate Equivalents are likely to be much lower. Starting in 1998, enriched cereal grains were required to be fortified with folic acid. The effect of this fortification is twofold; it increases both the amount of folate consumed and the absorption of folic acid compared with food folate, suggesting that usual folate intakes are much higher now compared with the time of the 1994-96 CSFII (Lewis et al. 1999; and Suitor and Bailey 2000).

The results for NSLP and SBP participants also are important to interpret in the context of the timing of the 1994-1996 CSFII. USDA regulations in June 1995 required school food authorities to prepare meals that met new nutrition standards for fat, saturated fat, and other key

nutrients. These requirements were not imposed on most schools during the period covered by the 1994-1996 CSFII, so dietary intakes of NSLP and SBP participants surveyed during that time period do not accurately reflect current intakes of program participants.

Another limitation of the CSFII data is that nutrients from dietary supplements are not available. To examine the possible effects of dietary supplements, a limited analysis of data from the Third National Health and Nutrition Examination Survey (NHANES III) was conducted. The results from the analysis of NHANES III data suggest that including supplements does not change estimates of inadequacy much. Results on supplement use from another study suggest that for some groups, supplement use may contribute to closing the gap between nutrient consumption from foods and nutrient requirements (Fox and Cole 2004). That study, also based on NHANES III data, found that among adults over age 60 with incomes below 130 percent of poverty, 25 percent reported taking a multivitamin or vitamin/mineral combination. Higher income seniors were even more likely to take such a supplement (37 percent), but many groups reported smaller proportions: only 7 percent of male teens in households below 130 percent of poverty reported taking a multivitamin or vitamin/mineral combination.

Few respondents reported taking a single mineral supplement such as calcium, and the calcium content of most multivitamin supplements is low relative to requirements; thus intakes of calcium appear to be unlikely to have been increased substantially by supplement use. Similarly, fiber intake from supplements is probably low for all groups other than older adults. For micronutrients such as vitamins E, A, and C, however, the prevalence of inadequacy could be somewhat lower with supplement use taken into account. Further research is needed to determine whether supplement use is higher for individuals with lower nutrient intakes from foods, and how regularly supplements are actually consumed. In addition, the limited sample

sizes of some of the vulnerable subgroups in NHANES III, as well as methodological issues on how to combine food frequency data on supplement with 24-hour dietary recall data on foods consumed, suggest that additional research is needed on how best to collect and analyze data on supplement use in studies of nutrient adequacy.

The difference between mean estimated energy requirements (EERs) and mean energy intakes for adolescents and adults suggests that some individuals are underreporting intakes. If energy intakes are less than requirements for specific subgroups, then individuals cannot maintain their weight and these subgroups would then experience weight loss. It is well documented, however, that the opposite has occurred; over the past three to four decades, there has been an increase in the prevalence of overweight and obesity. Given the increase in the prevalence of overweight and obesity, underreporting of food intakes is the likely explanation for the difference between mean EER and mean energy intakes. Moreover, given that the difference between mean EER and mean energy intakes is typically greater for overweight than for non-overweight subgroups, underreporting appears to be associated with overweight.

Given the underreporting of energy intakes, an important question is the extent to which the prevalence of inadequacy for micronutrients and protein is therefore overestimated. It is not possible to answer this question precisely since it depends on the extent of underreporting and the correlation between energy and micronutrient intakes. Nonetheless, given the very high prevalence of inadequacy for some micronutrients—vitamin E and magnesium in particular—and the low intakes of calcium, it is unlikely that underreporting accounts fully for the apparent deficiencies in the intakes of these nutrients. For protein, however, it is likely that underreporting accounts for much of the prevalence of inadequacy for some subgroups, especially in light of the finding that the percentage with usual protein intakes outside the AMDR is low for almost all subgroups.

For children, underreporting of energy intakes does not appear to be an issue. In fact, the opposite is observed; mean energy intakes are considerably larger than mean EERs for children 1 to 3 years and 4 to 8 years. Although the increasing prevalence of overweight and obesity among children is consistent with an excess of energy intakes over requirements, the magnitude of the difference between mean intake and mean EER suggests that parents or caregivers either overestimate what their child actually consumes or report weight and height of their child that results in an underestimate of mean EER (underestimate their child's weight or overestimate their child's height). This finding of excess energy intakes relative to energy requirements also has been observed in other studies (Devaney et al. 2004). An interesting implication is the extent to which overreporting food intakes (because of its social desirability) leads to overfeeding of foods to children. In addition, if parents overreport the intakes of children, then the true prevalence of inadequacy for children may be higher than that estimated from dietary recall data.

Caution is needed when interpreting the high prevalence of inadequacy for vitamin E. Vitamin E shows extremely high levels of inadequacy; for some subgroups, the prevalence is 100 percent, and it is the only nutrient with a high prevalence of inadequacy among young children. This result of apparent inadequate vitamin E intakes has been found in other studies (Devaney et al. 2004; Suitor and Gleason 2002). However, clinical data on vitamin E inadequacy suggest otherwise. Data from NHANES III show that, although a majority of age and gender subgroups had a large proportion with usual intakes below the EAR, less than 5 percent had low plasma vitamin E levels (Institute of Medicine 1997). The possible reasons for the very high estimate of nutrient inadequacy in light of a low prevalence of clinical inadequacy include the difficulty in providing accurate information on the types and amounts of oils and fats added during cooking and potential issues related nutrient databases. In addition, the results for

vitamin E may also suggest additional research is needed to support the DRIs established for vitamin E.

For magnesium, the proportion with inadequate intake is high for most subgroups examined. For adolescent and adult subgroups, the estimates all exceed 50 percent and are as high as 98 percent for adolescent females. Other studies also report this finding about high levels of inadequacy for zinc (Sutor and Gleason 2002; and Institute of Medicine 2004).

For all subgroups examined, mean intakes of dietary fiber are far below the AI for total fiber. Since total fiber includes both dietary fiber and functional fiber, it is somewhat misleading to compare intakes of dietary fiber with an AI for total fiber. However, the discrepancy between the intakes of dietary fiber and the AI—even the 90th percentile of dietary fiber is usually less than the AI—suggests that the U.S. population as a whole does not consume enough fiber.

Interestingly, a substantial proportion of children, especially young children, have usual intakes of zinc exceeding the UL. This finding is reported in other studies (Devaney et al. 2004; and Institute of Medicine 2004) and is apparently the result of a narrow margin between the RDA and UL for zinc in young children. In addition, this finding of a substantial proportion of children having usual zinc intakes above the UL appears inconsistent with empirical evidence showing few adverse health outcomes associated with excessive zinc consumption.

While the discussion and caveats above clearly suggest caution in interpreting the results presented in this report, concerns persist about dietary inadequacies and imbalances. Mean calcium intake of all adolescent and adult females is far below the AI set for calcium, suggesting calcium inadequacy. In addition, usual fat and carbohydrate intakes as a percent of food energy intake indicate an imbalance in diets of many adolescent and adult subgroups—too much fat and not enough carbohydrate. Finally, many of the dietary concerns are more pronounced among

low-income and overweight individuals, as well as some age and gender subgroups known to have dietary problems—adolescent females and older adults.